

WATER POSSIBILITIES FROM THE
GLACIAL DRIFT OF
GRUNDY COUNTY

BY

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Water Resources Report 1

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OF GRUNDY COUNTY

By Dale L. Fuller and W. B. Russell



1956
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MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES ROLLA, MO.

William C. Hayes, State Geologist and Director

WATER POSSIBILITIES FROM THE GLACIAL DRIFT OF GRUNDY COUNTY

A special study of groundwater by the Missouri Geological Survey and Water Resources was made possible at the 1955 session of the Missouri legislature. With the approval of the Governor, money was appropriated from the Missouri Post War Surplus Reserve Fund.

Since approximately two-thirds of those counties located north of the Missouri River are deficient in water supplies, much of the effort of this special study is being directed toward the problems of this area.

It has been shown that a program of test drilling can locate new reserves of groundwater. Potential areas are being tested so that additional supplies will be available for domestic, irrigation, industrial and municipal needs.

The most favorable areas are in the sand and gravel filled channels and valleys of pre-glacial and inter-glacial streams. Since these buried valleys do not conform to present day drainage patterns, a systematic program of test drilling is a principal means of locating the channels and mapping their extent. Such glacial deposits have proved to be excellent sources of groundwater.

QUALITY OF WATER FROM ROCK WELLS

The water from the consolidated rock formations which underlie Grundy County are, for the most part, too mineralized for use. In general, the mineral content of the water increases with depth of the rock well. The

quality and quantity of water from the consolidated rock wells may be illustrated by data from the Chicago, Milwaukee, St. Paul and Pacific Railroad well, and the Newton Robinson well.

Constituents	In Parts Per Million	
	I	II
Turbidity	20	Turbid
Odor	None	None
Color	----	None
pH	8.2	----
Alkalinity (CaCO ₃)	464.5	502.1
Phenolphthalein	28.0	----
Methyl Orange	436.5	----
Carbonate (CO ₃)	16.8	7.1
Bicarbonate (HCO ₃)	532.5	612.3
Silica (SiO ₂)	2.6	6.8
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	1.7	0.63*
Calcium (Ca)	26.4	35.7
Magnesium (Mg)	14.1	18.9
Sodium (Na) and Potassium (K) as Na	1603.6	2406.7
Total Manganese (Mn)	0.05	0.03
Iron (Fe)	3.31	----
Dissolved Iron	0.03	0.12
Precipitated Iron	3.28	----
Sulfate (SO ₄)	411.3	1127.9
Chloride (Cl)	1887.5	2549.7
Nitrate (NO ₃)	0.0	0.0
Fluoride (F)	1.3	1.50
Total Suspended Matter	0.	----
Total Dissolved Solids	4331.	6781.0
Total Hardness	123.9	166.7
Carbonate Hardness	464.5	166.7
Non-Carbonate Hardness	0.	----
Percent of Alkalies	96.	97.

*Al₂O₃ only

- I. Owner: Newton Robinson. SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 8, T. 60 N., R. 25 W., total depth 408 feet in rocks of the Pennsylvanian system. 408 feet of casing. Static water level 200 feet. Yield $\frac{1}{2}$ gallon per minute. Temperature of water 50° F., of the air 22° F. Collected January 17, 1956. Analyst: M. E. Phillips.

- II. Owner: Chicago, Milwaukee, St. Paul and Pacific Railroad. Sec. 12, T. 60 N., R. 23 W., at Laredo. Total depth 479 feet in rocks of the Pennsylvanian and Mississippian systems. Yield one gallon per minute. Water sample from depth of 416 feet. Analyzed April 27, 1937 by R. T. Rolufs.

Referring to Plate 1, it will be noted that a large area of Grundy County is unfavorably located to obtain water from glacial drift. Wells drilled into the consolidated rock to moderate depths may possibly obtain limited yields of water of marginal quality.

QUALITY AND QUANTITY OF WATER FROM STREAMS

The streams of Grundy County have long been used as a source of water for cities. Only in recent years have they been used for irrigation. The quality of the water from the streams is good as is illustrated by the following analyses. Unfortunately, in drought years when the water is needed most, the flow becomes inadequate in volume. The following are analyses from the Thompson River (A) and West Fork Medicine Creek (B):

Constituents	In Parts Per Million	
	A	B
Turbidity	20	2
Odor	none	none
pH	8.2	8.05
Alkalinity (CaCO ₃)	182.5	180.0
Phenolphthalein	13.0	16.0
Methyl Orange	169.5	164.0
Carbonate (CO ₃)	7.8	9.6
Bicarbonate (HCO ₃)	206.8	200.1
Silica (SiO ₂)	5.8	6.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	0.6	1.0
Calcium (Ca)	58.5	55.7
Magnesium (Mg)	12.5	13.6
Sodium (Na) and Potassium (K) as Na	16.7	21.0
Total Manganese (Mn)	0.00	1.03

Constituents	In Parts Per Million	
Total Iron (Fe)	0.39	0.34
Dissolved Iron	0.04	0.08
Precipitated Iron	0.35	0.26
Sulfate (SO ₄)	40.5	53.7
Chloride (Cl)	3.8	3.8
Nitrate (NO ₃)	0.1	0.0
Fluoride (F)	0.6	0.2
Total Suspended Matter	9.	7.
Total Dissolved Solids	261.	273.
Total Hardness	197.5	195.1
Carbonate Hardness	182.5	180.0
Non-Carbonate Hardness	15.0	15.1
Percent of Alkalies	16	19

- (A) Thompson River at Trenton, sec. 18, T. 61 N., R. 24 W., sampled October 26, 1955. Temperature of water 62° F, temperature of air 74° F. Analyst: M. E. Phillips.
- (B) West Fork Medicine Creek at Galt, sec. 33, T. 62 N., R. 22 W. Sampled November 21, 1955. Temperature of water 49° F., temperature of air 46° F. Analyst: M. E. Phillips.

The following are stream flow data from: Bolon, Harry C., Surface Waters of Missouri, Missouri Geological Survey and Water Resources, 2d ser., Vol. 34, p. 334 and 360, 1952.

Thompson River at Trenton

Location. - Wire-weight gage, lat. 40° 04'45", long. 93° 38'35", in SW $\frac{1}{4}$ sec. 18, T. 61 N., R. 24 W., at bridge on State Highway 6, 1 mile west of Trenton and 1 $\frac{3}{4}$ miles downstream from Weldon River. Datum of gage is 721.58 feet above mean sea level, datum of 1929. Wire-weight gage at site 1 $\frac{1}{2}$ miles downstream, at datum 3.46 feet lower, Sept. 16, 1930 to May 31, 1945.

Drainage Area. - 1,670 square miles. From Sept. 16, 1930 to May 31, 1945, 1,680 square miles.

Records Available. - August 1928 to September 1949. Gage-height records collected in vicinity 1910-14 and since 1925 contained in reports of U. S. Weather Bureau.

Average Discharge. - 21 years, 894 second-feet.*

Extremes. - 1928-49: Maximum discharge, 95,000 second-feet June 6, 1947 (gage height, 25.7 feet, from floodmark); 1.1 second-feet Aug. 10, 1934.

Maximum stage known, 30.7 feet July 6, 1909, present site and datum from information by local residents (occurred before new channel was dredged).

Remarks. - Records fair to poor.

Cooperation. - Station maintained by Surface Water Branch U. S. Geological Survey in Cooperation with Corps of Engineers. Gage-height record collected in cooperation with U. S. Weather Bureau.

*one second-foot equals 448.83 gallons per minute.

Medicine Creek Near Galt

Location. - Wire-weight gage, lat. $40^{\circ} 07'58''$, long. $93^{\circ} 21'50''$, in NW $\frac{1}{4}$ sec. 34, T. 62 N., R. 22 W., at bridge on State Highway 6, $1\frac{1}{2}$ miles upstream from West Medicine Creek and $1\frac{1}{2}$ miles east of Galt. Datum of gage is 769.21 feet above mean sea level, datum of 1929.

Drainage Area. - 225 square miles.

Records Available. - July 1921 to September 1949.

Average Discharge. - 26 years (1921-24, 1925-28, 1929-49), 135 second-feet.

Extremes. - 1921-49: Maximum discharge, 24,200 second-feet June 6, 1947 (gage height, 18.9 feet, from floodmark); no flow on many days.

Remarks. - Records fair to poor.

In general, the water from the glacial drift is high in total iron, total dissolved solids, and sulfates. The iron content in the water may cause staining of plumbing fixtures and laundry; however, relatively inexpensive water treatment for the iron will prevent this staining. For most types of irrigation, total dissolved solids should not exceed 2,000 parts per million and total alkalies should not exceed 75 percent. Most people cannot tolerate water for drinking purposes which contains more than 1,500 parts per million of chloride, or 2,000 parts per million sulfate. Water with 300 parts per million of chloride taste salty to some people. Sulfates in excess of 500 parts per million may have a laxative effect when first used for drinking.

Constituents	In Parts Per Million				
	1	2	3	4	5
Turbidity	40	25.0	150	murky	grey
Odor	none		none	none	none
pH	7.8	6.6	7.3	8.2	7.25
Alkalinity (CaCO ₃)	262.0	121.0	173.5	130.0	294.5
Phenolphthalein	0.0	0	0.0	0.0	0.0
Methyl Orange	262.0	121.0	173.5	130.0	294.5
Bicarbonate (HCO ₃)	319.6	147.9	211.7	158.6	359.3
Carbonate (CO ₃)	0.0	0	0.0	0.0	0.0
Silica (SiO ₂)	9.7	8.0	12.7	21.3	12.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	3.0		2.0	8.3	3.0
Calcium (Ca)	105.5	86.2	325.3	34.7	114.4
Magnesium (Mg)	36.1	17.4	122.7	9.9	30.4
Sodium (Na) & Potassium (K) as Na	247.1	27.2	332.8	37.0	99.9
Manganese (Mn) Total	0.00		0.40	0.00	0.40
Total Iron (Fe)	3.13	2.5	9.82	7.08	11.35
Precipitated Iron	2.55		9.55	5.59	11.32
Dissolved Iron	0.58		0.27	1.49	0.03
Sulfate (SO ₄)	602.1	184.6	1717.7	37.7	278.2
Chloride (Cl)	35.5	15.2	22.0	31.0	6.0
Nitrate (NO ₃)	0.0	0.3	0.0	0.0	0.3
Fluoride (F)	---		0.7	---	---
Total Suspended Matter	17.		134.	---	462.
Total Dissolved Solids	1235.	521.0	2849.	290.	737.
Total Hardness	412.1	287.0	1317.4	127.4	410.8
Carbonate Hardness	262.0	121.0	173.5	130.0	294.5
Non-Carbonate Hardness	150.1	166.0	1143.9	---	116.3
Percent of Alkalies	57	17	35	39	34

- (1) Owner: Donald Whitt, SE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 29, T. 63 N., R. 25 W., total depth 125 feet. Collected November 17, 1955. Analyst: M. E. Phillips.
- (2) Owner: City of Spickard. Sample direct from well August 31, 1954. Analyses by Missouri Division of Health.
- (3) Owner: Monte Howe, NW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 26, T. 63 N., R. 24 W. Total depth 167 feet, static water level 57 feet. Sampled direct from pump February 23, 1956. Temperature of water 54° F., of the air 36° F. Analyst: M. E. Phillips.
- (4) Missouri Geological Survey, Test Hole #31. NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 26, T. 63 N. R. 23 W. Total depth 240 feet. Temperature of water 59° F., of the air 69° F. Collected October 12, 1955. Analyst: M. E. Phillips.
- (5) Owner: Kenneth Howe, NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 21, T. 62 N., R. 24W., total depth 86 feet. Temperature of water 55° F., of the air 82° F. Collected September 9, 1955. Analyst: M. E. Phillips.

Constituents	In Parts Per Million			
	6	7	8	9
Turbidity	grey	25.0	tan	9
Odor	none	none	none	none
pH	7.4		7.2	7.95
Alkalinity (CaCO ₃)	356.5	120.0	209.0	345.5
Phenolphthalein	0.0	0	0.0	20.0
Methyl Orange	356.5	120.0	209.0	325.5
Bicarbonate (HCO ₃)	434.9	146.0	255.0	397.1
Carbonate	0.0	0	0.0	12.0
Silica (SiO ₂)	21.5		12.0	10.3
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	9.5		2.0	1.3
Calcium (Ca)	505.0	244.6	249.9	75.1
Magnesium (Mg)	136.8	49.0	82.8	19.8
Sodium (Na) and Potassium (K) as Na	210.9	114.4	360.3	44.2
Manganese (Mn) Total	3.89		0.0	0.00
Total Iron (Fe)	0.14	1.6	5.85	1.85
Precipitated Iron	0.12		5.76	1.84
Dissolved Iron	0.02		0.09	0.01
Sulfate (SO ₄)	1811.6	709.6	1384.4	5.4
Chloride (Cl)	16.8	122.4	23.5	8.0
Nitrate (NO ₃)	0.0	0.9	3.7	0.6
Fluoride (F)	---		---	0.0
Total Suspended Matter	---		35.	4.
Total Dissolved Solids	3236.	1636.0	2413.	377.
Total Hardness	1824.1	813.0	964.9	269.0
Carbonate Hardness	356.5	120.0	209.0	345.5
Non-Carbonate Hardness	1467.6	693.0	755.9	0.
Percent of Alkalies	20	23	65	26

- (6) Mo. Geological Survey Test Hole #10. NW $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 20, T. 62 N., R. 23 W. Total depth 195 feet. Temperature of water 57° F., of the air 94° F. Collected September 14, 1955. Analyst: M. E. Phillips.
- (7) Owner: City of Galt. 16' dug well 15' S.W. OF C.M. and St. Paul R.R. depot, 600' east of creek and 1,000' east of city limits. Collected April 14, 1945. Analyses by Missouri Division of Health.
- (8) Owner: Grundy County Rest Home. SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 12, T. 61 N., R. 24 W. Total depth 242 feet. Temperature of water 56° F., of the air 74° F. Collected September 9, 1955. Analyst: M. E. Phillips.
- (9) Owner: Charles Mack. SW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 14, T. 60 N., R. 23 W. Total depth 139 feet. Static water level 86 feet. Temperature of water 48° F., of air 18° F. Collected January 17, 1956. Analyst: M. E. Phillips.

QUANTITY OF WATER FROM GLACIAL DRIFT

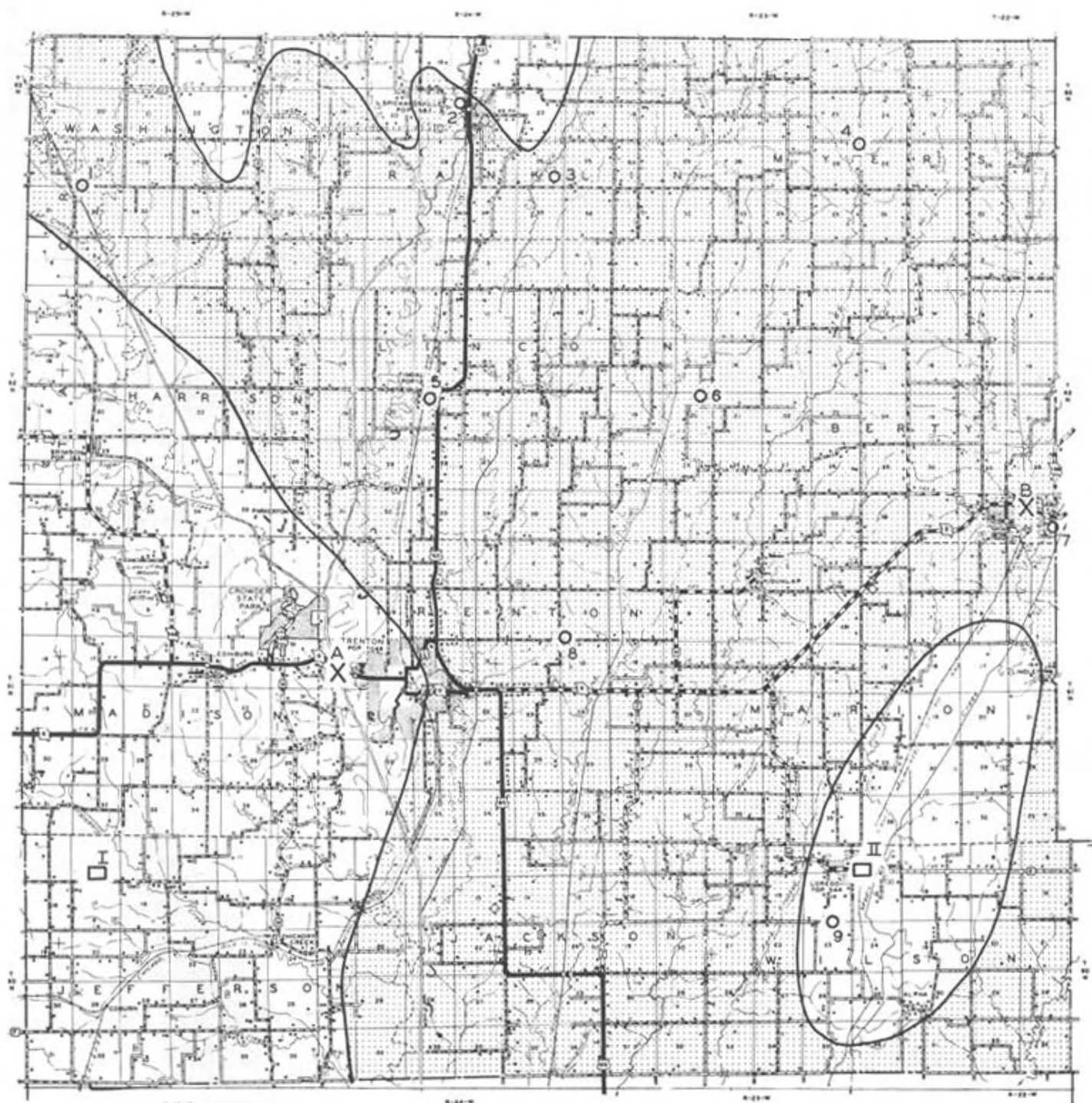
DOMESTIC WELLS - Included in this category are wells developed for household or general farm use. Yields required from domestic wells vary but seldom exceed 15 gallons per minute. In some parts of Grundy County sands and gravels were not deposited in the glacial drift. There are also areas where the glacial drift cover is relatively thin or lacking. In such areas the possibility of developing wells is limited. Plate 1 shows the area most favorable for the development of domestic wells. Plate 3 is a contour map showing the elevation of bedrock above sea level. To determine probable drilling depths, the elevation of the bedrock should be subtracted from the surface elevation for each specific site. Plate 3 shows the locations of the test holes and the thickness of the glacial drift encountered.

IRRIGATION WELLS - Included in this category are all high yield wells whether used by cities, by industries, or for irrigation. Plate 2 shows the area most favorable for the development of irrigation wells. Also shown are the locations of eleven tests which flowed. With proper development, yields of 200-1,000 gallons per minute may be obtained. Yields to be expected are contingent upon several factors:

- (1) The thickness of the sand and gravel beds.
- (2) The size and sorting of the sand and gravel.
- (3) The manner of construction and materials used, such as proper well screen, gravel pack, etc.
- (4) Ability of the well driller to develop the full capacity of the water bearing sands.

Continued successful production is contingent upon:

- (1) Re-charge rate of the water-bearing horizons.
- (2) Quality of the screen and materials used.
- (3) Subsequent well treatment such as acidizing.
- (4) Avoidance of over-pumpage.



Base by the Missouri State Highway Department, 1950

LEGEND



Area most favorable



Location of wells in drift from which water was analyzed



Water sample analyzed from a "rock" well



Water sample analyzed from a stream

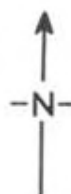


PLATE I

MAP OF GRUNDY COUNTY SHOWING

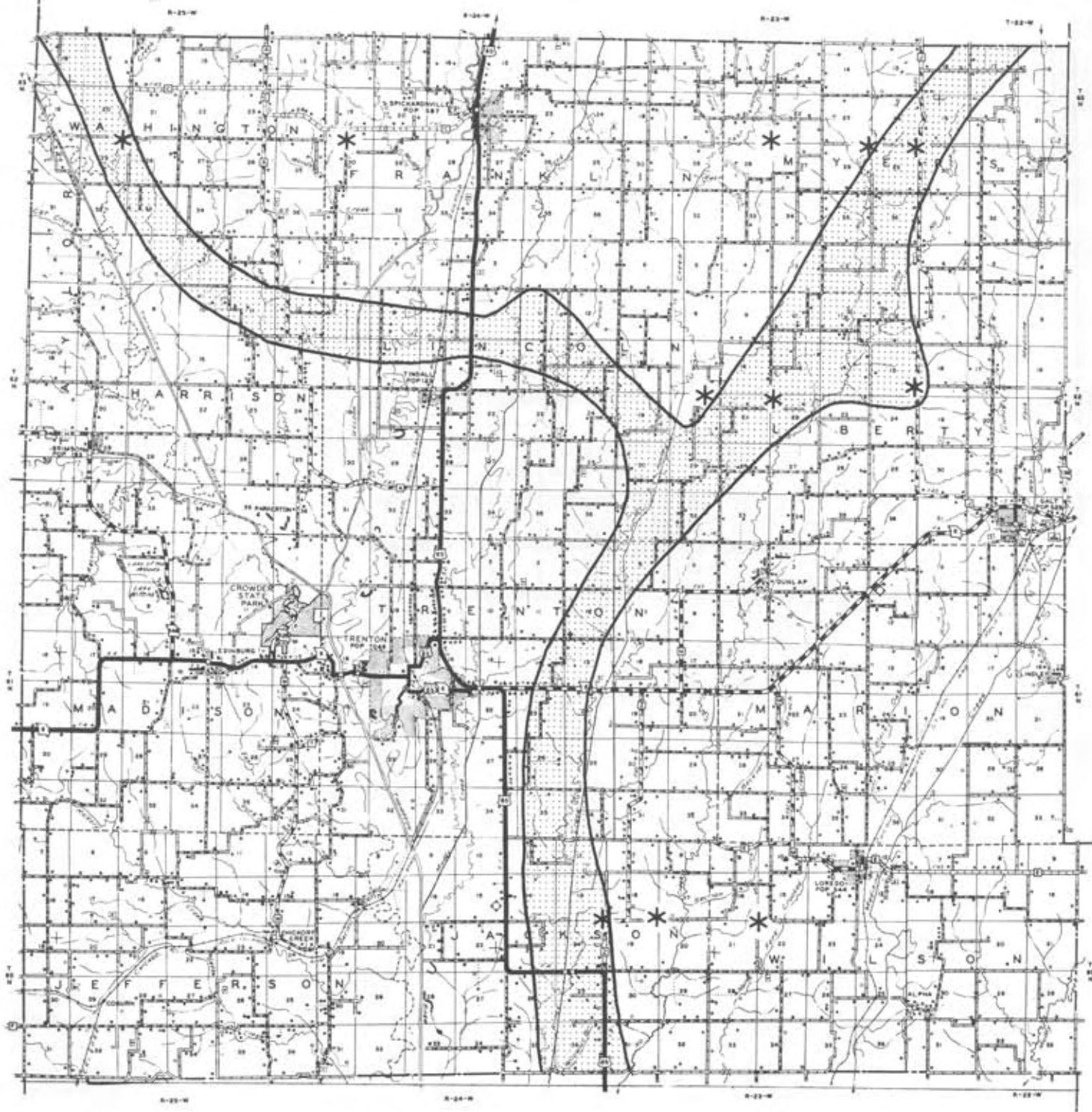
AREA MOST FAVORABLE FOR THE
DEVELOPMENT OF WELLS IN DRIFT

BY
DALE L. FULLER
AND
W. B. RUSSELL

1956
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MISSOURI GEOLOGICAL SURVEY
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ROLLA, MISSOURI

THOMAS R. BEVERIDGE
STATE GEOLOGIST



Base by the Missouri State Highway Department, 1950

LEGEND



Drift filled valley



Test wells that flowed

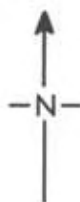


PLATE 2

MAP OF GRUNDY COUNTY

SHOWING

DRIFT FILLED VALLEYS IN WHICH
IRRIGATION WELLS POSSIBLY CAN
BE DEVELOPED

BY

DALE L. FULLER

AND

W. B. RUSSELL

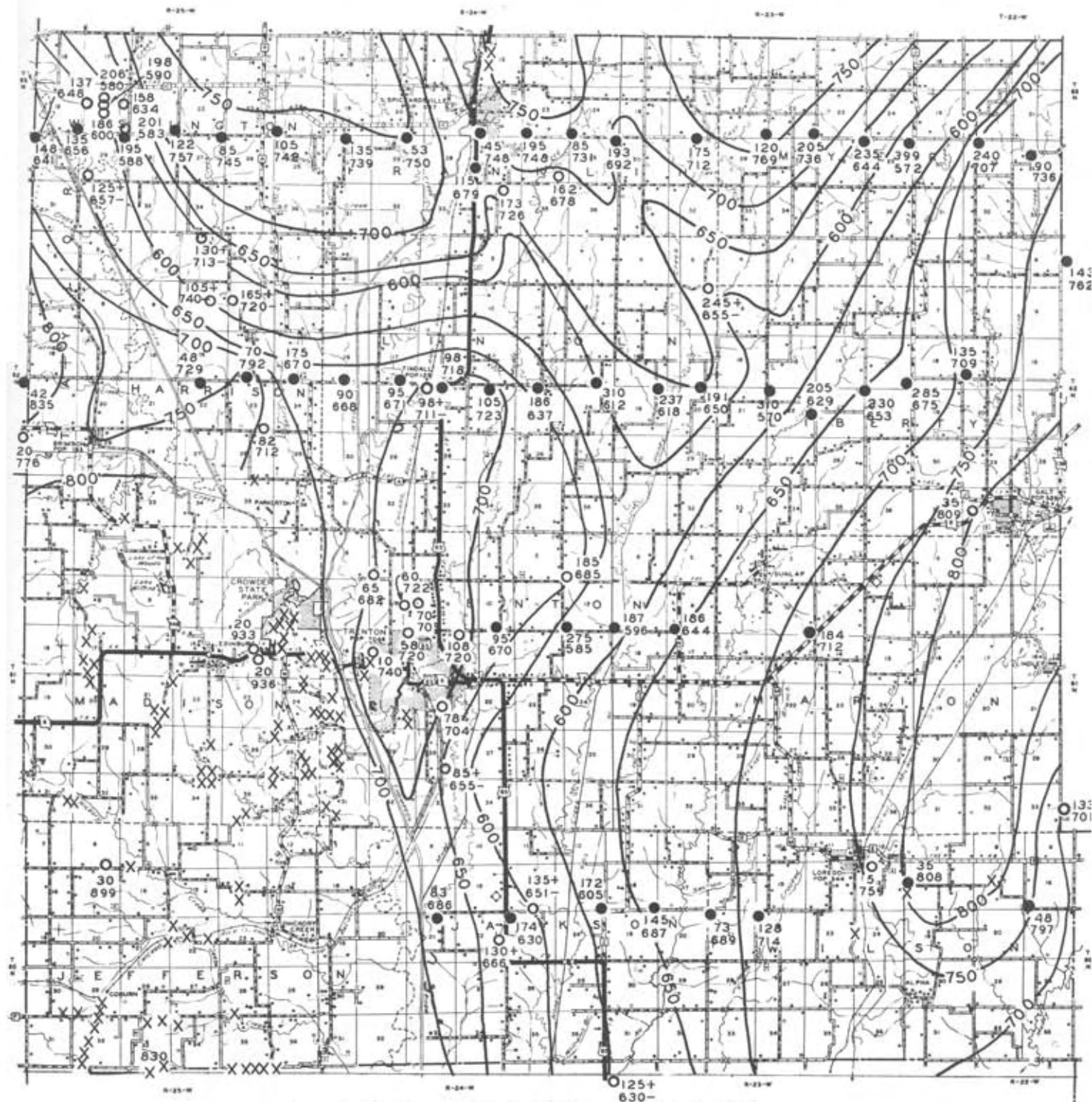
1956

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LEGEND

- 135
650 Test holes showing thickness in feet
of drift and elevation of bedrock
above sea level
- Water wells
- X Bedrock Outcrops
- 920 Indicates outcrop elevation

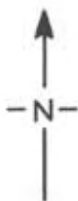


PLATE 3

MAP OF GRUNDY COUNTY CONTOURED TO SHOW BEDROCK ELEVATIONS

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THOMAS R. BEVERIDGE
STATE GEOLOGIST

SUMMARY

Approximately 40,000 acres of Grundy County are located within the area in which irrigation wells possibly can be developed. Approximately three-fourths of Grundy County has been shown to have water supplies ample for domestic needs. Questions concerning water problems for a specific location should be sent to the Missouri Geological Survey and Water Resources, Buehler Park, Box 250, Rolla, Missouri 65401.